Synopsis V1.0
Single Event Transient and Destructive Testing of the
M.S. Kennedy Corp. MSK5275 Low Dropout Voltage Regulator

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I. Introduction

This study was undertaken to determine the single event destructive and transient susceptibility of the MSK5275 Low Dropout Voltage Regulator. The device was monitored for transient interruptions in the output signal and for destructive events induced by exposing it to a heavy ion beam at the Texas A&M University Cyclotron Single Event Effects Test Facility.

II. Devices Tested

The sample size of the testing was two devices. The devices were manufactured by M.S. Kennedy Corp. and were characterized prior to exposure. The devices tested had a Lot Date Code of 0312.

III. Test Facility

Facility: Texas A&M University Cyclotron Single Event Effects Test Facility, 15 MeV/amu tune.
Flux: 4.0×10^3 to 4.0×10^4 particles/cm^2/s.

Ion	LET (MeVcm^2/mg)
Ne	2.8
Ar	8.7

IV. Test Methods

The test setup for the MSK5275 (Figure 1) contains an input Power Source, a programmable electronic load, and a digital oscilloscope. The Load is programmed to allow close to Maximum current flow allowed by the component specifications and the digital oscilloscope is setup to trigger on any voltage "drop outs" from the regulator.

The MSK5275 receives an input voltage (5 volts) from the Power Source, and produces a regulated output voltage of 2.5 Volts and 5 Amps which is determined by the programmable electronic load (Figure 2).

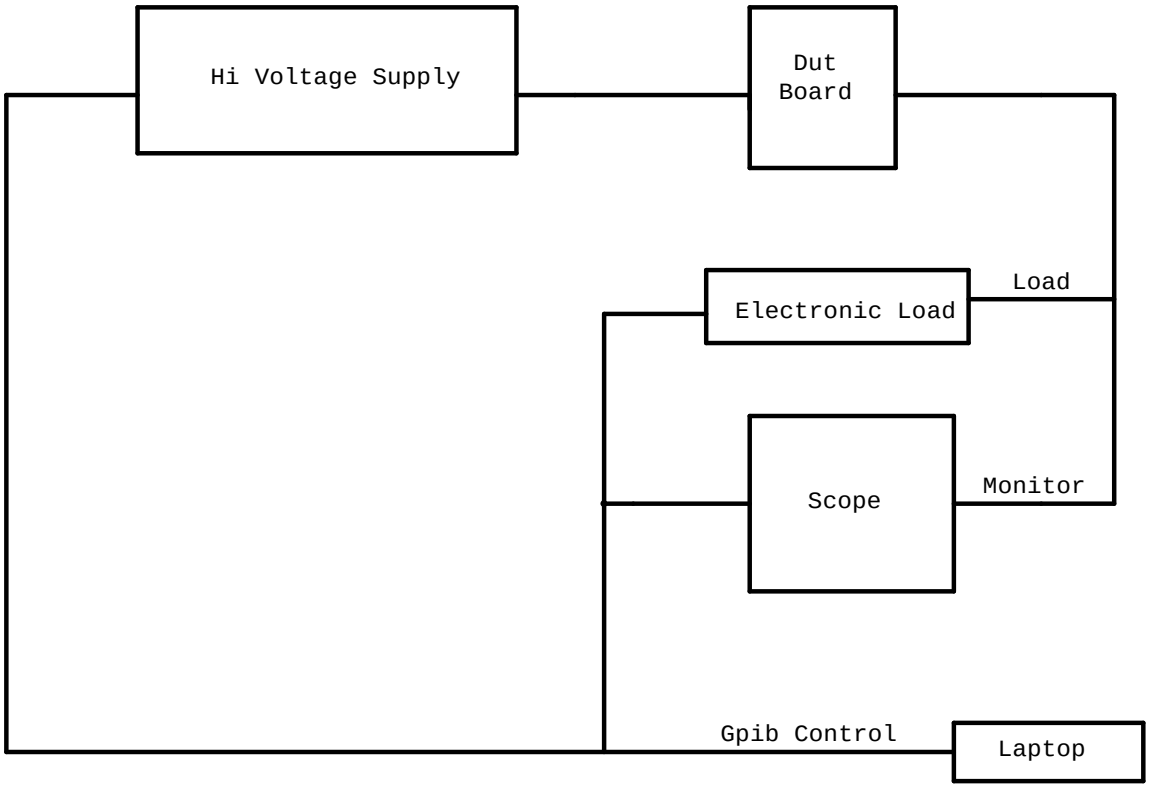

Figure 1. Overall Block Diagram for the testing of the MSK5275.

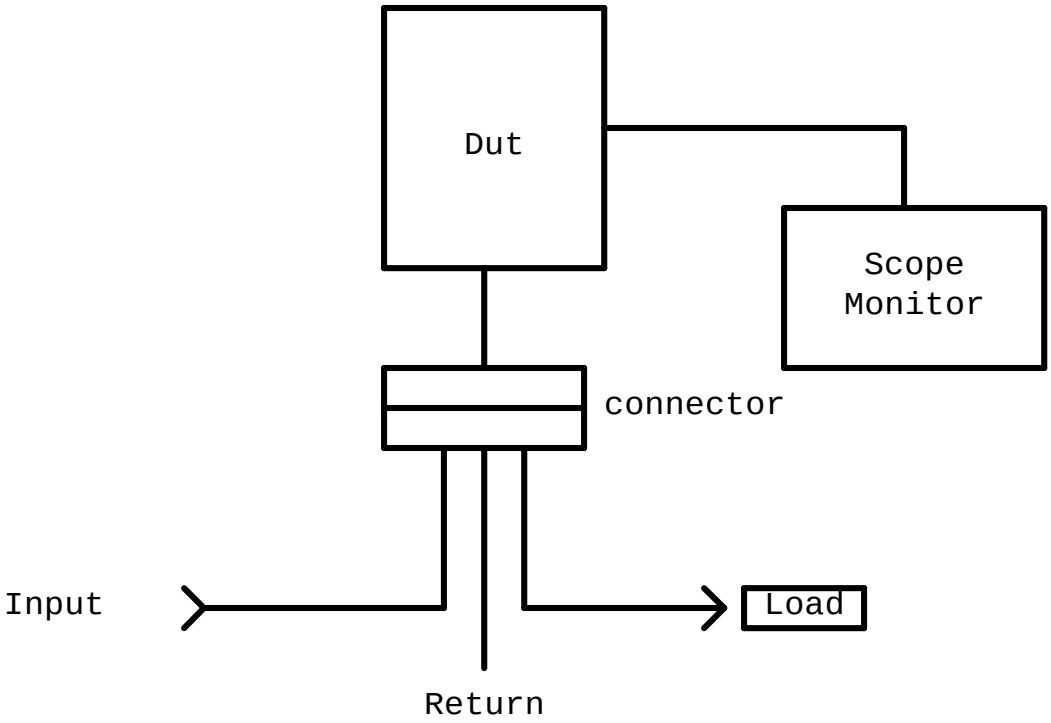

Figure 2. Block Diagram of the DUT board for the testing of the MSK5275.

V. Results

During testing the two MSK5275 devices were irradiated with the Neon, and Argon, beams at normal incidence (yielding an effective LETs of approximately 2.8 and 8.7 MeV-cm^2/mg). Transients from the MSK5275 were encountered with both beams.

The three MSK5275 Voltage Regulators were tested to measure the latchup and dropout cross sections under the above conditions. Each part was place in the beam until a latch or dropout event occurred or 10^7 ions/cm^2 – the beam fluence was then recorded. During our experiment, no latchup or dropout events occurred, yielding a threshold LET for latchup and dropout of > 8.7 MeV-cm^2/mg.

The two MSK5275 Voltage Regulators were also tested to measure the transient cross section under the above conditions. Each part was place in the beam until transient events occurred or 10^7 ions/cm^2 was reached. If many transients occurred, then a hundred samples were acquired and then the beam fluence recorded. During our experiment, transient events did occur.

The transients that did occur were in the form of oscillations. Upon exposure to either beam, the device would immediately go into an oscillation mode (See Figure 3) that would continue even after the ion beam was removed. A power cycle was required to, but did indeed recover normal operations.

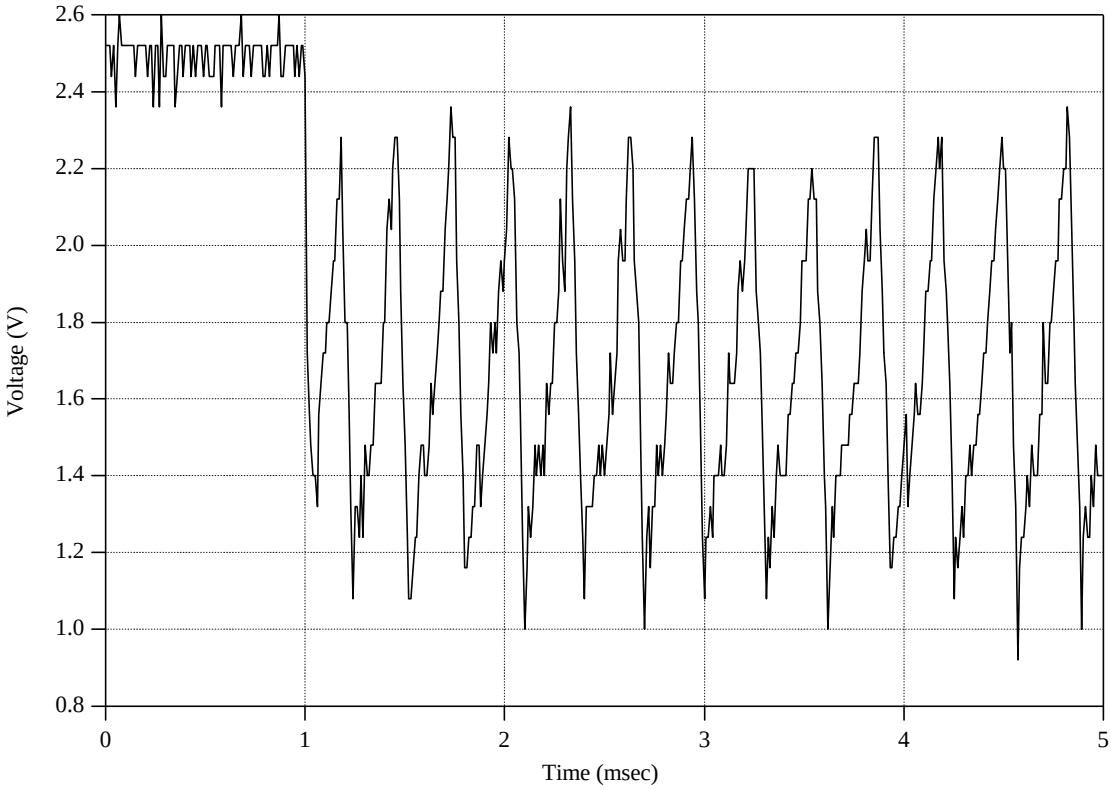

Figure 4. Transient taken from the output of the MSK5275 with normal incidence Argon beam.

With the low LET threshold for the oscillation events and the very nature of these oscillation events, testing at higher LETs was not deemed warranted.

VI. Recommendations

In general, devices are categorized based on heavy ion test data into one of the four following categories:

Category 1 – Recommended for usage in all NASA/GSFC spaceflight applications.
Category 2 – Recommended for usage in NASA/GSFC spaceflight applications, but may require mitigation techniques.
Category 3 – Recommended for usage in some NASA/GSFC spaceflight applications, but requires extensive mitigation techniques or hard failure recovery mode.
Category 4 – Not recommended for usage in any NASA/GSFC spaceflight applications.

The MSK5275 Low Dropout Voltage Regulators are Category 3 devices.